Educational technology use among K-12 Teachers: What technologies are available and what barriers are present?

Gregory M. Francom

Associate Professor of E-Learning

Northern State University

Dr. Gregory M. Francom is an Assistant Professor of E-Learning at Northern State University. His primary responsibilities include preparing pre-service and in-service K-12 teachers to effectively integrate technology into teaching and learning experiences. His research interests include task-centered learning, educational technology, and online learning.

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1. alignment with the convention theme and any relevant division theme
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Abstract

In order to prepare teachers to integrate technology into teaching and learning activities, teacher educators and administrators need current information about the types of technologies available in classrooms. The current survey research study of K-12 public school teachers in a rural North Midwestern state provides updated information on available technology tools and resources in large (non-rural) and small (rural) public school districts. Results reveal that access to technology tools and resources is increasing, and in some cases is more abundant in smaller school districts. Participants in this study also report using both student- and teacher-centered learning techniques to integrate technology.

Keywords: educational technology, classroom technology, rural, student-centered learning, school district

Technologies Available and Student-Centered Learning in Large and Small School Districts

In order for effective technology integration to take place, barriers to teacher use of technology use must be reduced. First-order barriers to technology integration include those that are external to the teacher and foremost among these barriers is the availability of technology tools and resources (Ertmer, 1999). It has been suggested that more and more technology tools and resources are becoming available in K-12 classrooms, reducing first-order barriers to technology integration (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). However, some research studies continue to indicate that a lack of access to technology tools and resources may continue to be a significant barrier to technology integration (Kale & Goh, 2014; Wright & Wilson, 2011). Questions remain as to exactly which technologies are commonly available in K-12 classrooms and schools.

There is a clear need for current information about the types of technologies available in United States K-12 schools and classrooms. Access to technology tools and resources is a necessary condition for effective technology-enhanced learning experiences. Knowing what technologies are currently available in classrooms can help teacher educators, professional development coordinators and K-12 administrators determine how best to prepare and support teachers to integrate technology into teaching and learning activities.

When access to technology tools and resources is provided, researchers have suggested that quality learning with technology means implementing student-centered learning experiences, and that student-centered learning is central to the future of education (Reigeluth, 2012; Reigeluth & Karnopp, 2013). Technology will play a central role in this student-centered future (Reigeluth et al., 2015; Reigeluth & Karnopp, 2013; Ruggiero & Mong, 2015).

The current study provides updated information on available technology tools and resources in K-12 public school classrooms. The current study also seeks to determine whether current teachers view their technology integration practices as student or teacher centered. This study can enhance our understanding of teachers' use of information technologies in different K-12 public educational settings in order to support the efforts of teacher educators and administrators to provide relevant technology training. Findings from this study can also help us predict the types of technologies and technology learning methods that exist in different types of classrooms based on the size of the school district, community or other district and classroom factors.

Technology Available in the Classroom

A teachers' access and use of technology is a strong indicator of whether his or her students will use technologies in the classroom (Inan & Lowther, 2010; Ritzhaupt, Dawson, & Cavanaugh, 2012). The most recent report from the National Center for Education Statistics (2009) indicated that 97% of teachers have access to a computer in their classroom (Gray, Thomas, & Lewis, 2010). Almost 40% of teachers had a classroom projector at this time, while only about 28% of teachers had an interactive whiteboard. A more recent study of 1048 teachers from over 1000 school districts reported that 99% of teachers use technology every day to support student learning (Ruggiero & Mong, 2015).

Perhaps the most effective technology arrangement in K-12 classrooms for supporting student-centered learning is the 1:1 environment in which each student has access to his or her own technological device. Such environments can support effective and efficient learning by allowing more hands-on time with technology learning activities for each student (Bebell & Kay, 2010; Bebell & O'Dwyer, 2010). The latest technology report from the National Center for

Education Statistics found that the ratio of students to computers in 2009 was 5.3:1 (Gray et al., 2010). Since then, this ratio has likely decreased to make the number of students to computers in the average classroom much closer to 1:1 (Ruggiero & Mong, 2015).

Questions remain as to the availability of technology tools and resources in different types of classrooms. Ertmer et al. (2012) have suggested that first-order barriers to technology integration have been decreasing as teachers continue to gain more and more access to technology tools and resources in schools. However, even more recent studies indicate that access to technology tools and resources may continue to be significant barriers (Kale & Goh, 2014; Wright & Wilson, 2011), especially in the case of smaller, more rural school districts (Howley, Wood, & Hough, 2011; Sundeen & Sundeen, 2013). However, technology tools and resources have great potential for helping overcome the potential problems endemic to a rural school district (Gordon, 2011).

Few studies have provided a systematic comparison of the availability of technology tools and resources between smaller, more rural public school districts and larger more suburban public school districts. A study by Lewis (2010) discussed rural teachers' perceptions and technology teaching practices, but did not compare these with those of non-rural teachers. Another study by Howley et al. (2011) examines rural vs. non-rural school districts on technology adequacy and found that rural teachers report more limited access to educational technologies. However, this study includes a narrow range of possible classroom technologies available. The current study builds upon the idea of comparing rural versus non-rural school districts, but is more comprehensive in its approach, taking into account a wider range of possible technologies available in the classroom and including a larger sample of respondents.

Student-Centered Learning

Access to technology tools and resources is a necessary condition for student-centered learning with technology (Reigeluth, Beatty, & Myers, 2016; Reigeluth & Karnopp, 2013; Ruggiero & Mong, 2015). Where technology tools and resources are readily available, teachers play a central role in determining whether a technology tool or resource will be used in the classroom. Research studies have found that many teachers tend to use technology in teacher-centered ways (Kale & Goh, 2014; Wright & Wilson, 2011). Newer teachers may have a higher comfort level with technology use, but they may tend to report using technology less frequently for in-class learning activities than more experienced teachers (Russell, Bebell, O'Dwyer, & O'Connor, 2003).

Teachers must have an advanced understanding of technology tools and resources in order to use technology in student-centered ways (Becker, 2000; Inan & Lowther, 2010; Wright & Wilson, 2011). Teacher beliefs about the effectiveness of student-centered and teacher-centered learning are also central to shaping that teacher's practice in the classroom (Andrew, 2007; Hermans, Tondeur, van Braak, & Valcke, 2008; Kim, Kim, Lee, Spector, & DeMeester, 2013). Teachers with student-centered beliefs about teaching and learning have tended to implement technology in student-centered ways and teachers with teacher-centered beliefs about teaching and learning tend to implement technology in teacher-centered ways (Andrew, 2007; Ertmer et al., 2012). Despite technological and administrative barriers to the contrary, teachers with student-centered beliefs have successfully implemented student-centered technology experiences (Ertmer et al., 2012).

While there is much written on student-centered technology learning, little research beyond that which has been reported here has been done to determine the types of settings in

which student-centered learning exists. More particularly, research about factors such as class, school and district size, and teacher years of experience that could link to student- or teacher-centered learning is still needed. The study by Howley et al. (2011) compares rural versus non-rural teachers on technology adequacy and teacher attitudes, however it does not provide information on student- versus teacher-centered learning. Of particular concern in the current study is whether there are significant differences between these types of learning between rural vs. non-rural school districts.

Purpose and Research Questions

The purpose of this survey research study was to compare different sized school districts on the availability of technology tools and resources and on student-centered learning with technology. The research questions for this study include the following:

- What technology tools are available in K-12 public education classrooms, and are there differences in availability of technology tools among smaller (rural) vs. larger (non-rural) school districts?
- What student-centered methods of technology integration are being used in K-12 public education classrooms and are there differences in these methods among smaller (rural) vs. larger (non-rural) school districts?

Method

Participants and Setting

A survey and follow up interviews were conducted with current teachers from K-12 public education institutions in a rural North Midwestern state in the United States. An email with a greeting and a link to the survey was sent to 12,161 school district employees. A total of 1,185 participants completed the survey. After removing respondents who did not consent to the

study or who did not currently work as a teacher, the total number of valid responses was N=1079.

Within the survey, participants were asked if they were willing to participate in a follow-up interview asking more in-depth questions about barriers to their technology use in the K-12 classroom and other aspects of their classroom practice. Though this study is primarily quantitative, a small number of interview participants (N=11) were purposefully selected from the pool of willing respondents to shed light on quantitative survey results. This small number of interview participants was selected to allow in-depth responses to a small list of selected questions without reaching data/theme saturation (Creswell, 2006; Mills & Gay, 2016). These participants were purposefully selected to provide perspectives from various different school districts, grades, and subjects. They came from elementary, middle school, and high school levels and represented a range from small (101-300 students) to large (more than 3,000 students) school districts and communities (300-600 people to more than 50,000 people).

Instruments

The instruments for this study included an educational technology survey and an interview protocol. The educational technology survey was developed to collect information in four main areas: (1) demographic information, (2) technologies in the classroom, (3) barriers and factors that relate to technology integration, and (4) student-centered uses of technology. The survey development was informed by previous literature on elements of student-centered learning with technology (An & Reigeluth, 2012; Francom, 2014; Reigeluth et al., 2016; Reigeluth & Karnopp, 2013), and barriers to technology integration (Ertmer, 1999; Hew & Brush, 2007; Kopcha, 2012; Ritzhaupt et al., 2012).

The completed educational technology survey included 48 questions. Thirteen of these questions included demographic information such as current work responsibility, age, school district and school size, number of people in the school's community, years of teaching experience, subject grade area taught and college degree earned. Information about technology tools available in the classroom was gathered using eight questions. These questions asked about technology hardware items that are always or almost always available in the classroom, and also such items that are available at the school but not in the classroom. The technology questions also asked about how often teachers use the available technology hardware items. There were nine questions that asked about student- and teacher-centered technology integration in the classroom. A few sample questions from this section of the survey include, "I primarily use technology tools and resources in my classroom to present slideshows and pictures to students," and "In my classroom, students use technology tools and resources to seek out and use information." Finally, 18 questions asked about different barriers to technology integration.

The interview question protocol included four sections; demographics, available technologies, technology use, and barriers to technology use. This protocol was used after the quantitative survey was administered and was designed to provide more in-depth information about teachers' survey responses.

Procedures

After the initial survey was developed, a pilot test of the survey was administered to four teachers within the population area. These teachers offered several different suggestions to improve and clarify the survey responses. The survey was edited and improved based on these comments from the pilot test.

Email addresses for teachers in the population were gathered by checking the website for each of the 150 school districts in the state. Email addresses for all faculty at these districts were gathered if available, and placed in a list for later email. If email addresses were not provided on the website but a faculty list was provided, then email addresses were derived from the faculty listing. A few districts had no online email or faculty listing and thus had to be excluded from the potential sample population. A total of 12,161 school district employees email addresses were collected.

When institutional IRB approval was obtained for this study, emails that included an invitation to participate were sent out to all of the 12,161 collected email addresses. Three emails were sent to each available participant with about a week's time in between each sending. At first sending, the researcher received feedback that some school districts blocked the survey at the link provided. The second and third emails sent out provided an alternative link, which could be accessed by a wider variety of school district personnel.

Interviews were conducted several months after the survey data were analyzed with statistical techniques. The interview participants were interviewed over the phone and recordings of the interviews were transcribed for qualitative content analysis.

Data Analysis

Survey responses (N=1079) were coded with number values and each question was analyzed for descriptive statistics. Question responses from the survey section on student-centered learning were also averaged for a total student-centered learning score. Statistical analyses in this study were run using ANOVA calculations. A significance level of $p = .05$ was applied throughout. Calculations of internal consistency for survey items within the student-centered learning area of the survey resulted in a reliable Cronbach's Alpha ($\alpha = .716$).

For the purpose of comparing large vs. small districts, district size information was classified into two groups: large (non-rural) and small (rural). Large districts were defined as those of more than 1500 students and small districts were defined as those with 1500 or fewer students. About half of the responses came from each of these groups. Community size data was simplified in a similar manner with communities of more than 5000 comprising larger (non-rural) communities and communities of up to 5000 people designated as smaller (rural) communities. About half of the responses also came from each of these two groups.

Follow-up interviews with participants were recorded and transcribed. The interview responses from all participants were combined into a single document and organized by question. The responses were further organized to separate participants in larger school districts and communities from participants in smaller school districts and communities. The interview responses were then analyzed for content and themes, and then connected to earlier quantitative survey findings.

Results

Demographics

Of 150 known public school districts in the state, 127 (84.6%) were represented in the survey. Respondents included teachers of every grade (K-12) and also covered a wide variety of subject areas, from K-5 grades to different subjects in middle and high school such as science, math, language arts, foreign language, art, physical education, health, business, family and consumer sciences, music, social studies, special education and more.

School districts from fewer than 100 students to more than 3,000 students were represented in this study. The majority of respondents reported coming from a school district of more than 3,000 students (34%), however the next largest group of respondents reported coming

from a school district of 101-300 students (about 23%). Respondents also reported coming from a variety of school sizes with the most common school size of 101-200 students (17.8%). The next most common school size was 401-500 students (about 13%) and then more than 1,000 students (12.9%).

Respondents reported average class sizes ranging from fewer than 10 students to more than 50 students. About 34% of respondents reported average class sizes of 21-25 students, which was the most common response, with and 16-20 students as the next most common response (22%). Respondents reported working in schools within communities ranging from fewer than 300 people to more than 50,000 people in population. About half of the respondents reported working at a school within a community of 5,000 people or smaller. About 23% reported working in a school in a community of more than 50,000 people, the most common response on the survey.

Respondents ranged all the way from 1-4 years up to more than 40 years of teaching experience. The most common response was 21-30 years experience (22.4%) with 1-4 years of experience as the second most common response (20.8%).

Available Technology Tools and Resources

The first research question addresses technology tools available in K-12 public education classrooms, and differences in availability of technology tools among larger (non-rural) vs. smaller (rural) school districts. The survey asked respondents to report technologies that are always or almost always available in their current classrooms. Figure 1 shows the responses to this question.

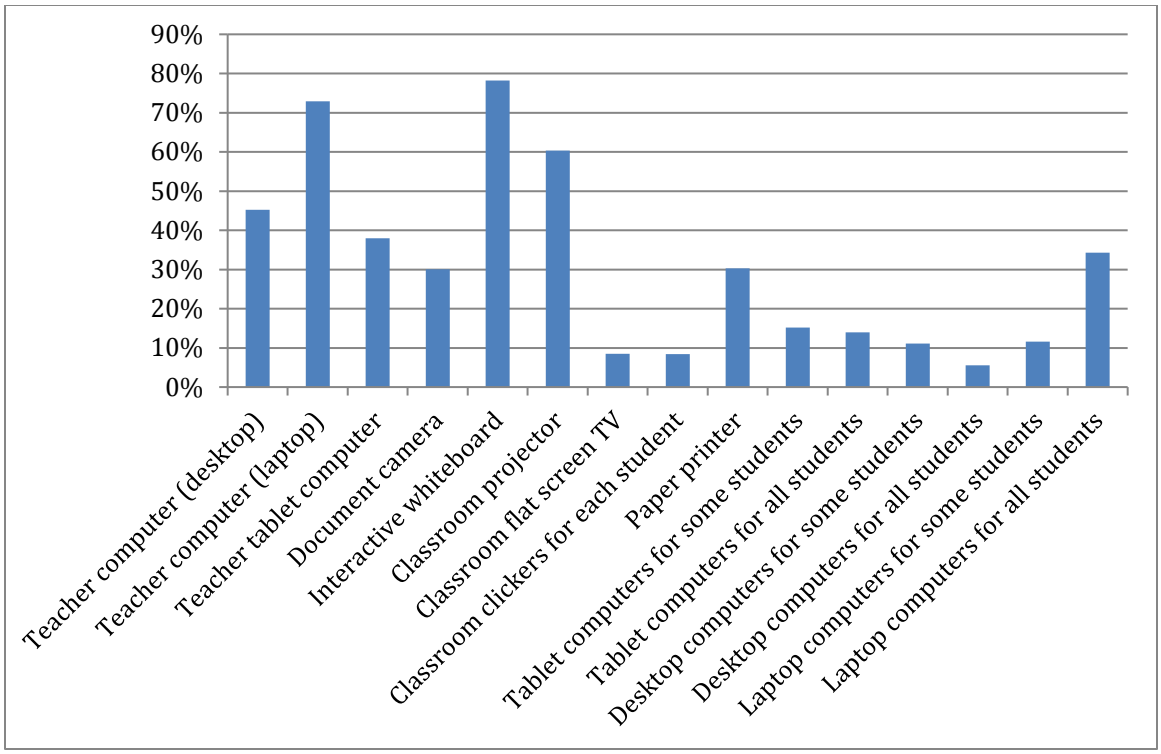

Figure 1. Technologies that are always or almost always available in respondents' classrooms.

The most common technology tool in the sample classrooms is the interactive whiteboard (78.2%), such as a Smart board, Promethean board or another brand. About 73% of teachers report having a work laptop, while only about 45% report having a desktop computer to work with in the classroom. Some of the other most commonly reported technology tools in the classrooms of this study include a classroom projector (60.3%), a teacher tablet computer (38%), laptop computers for all students (34.3%), paper printer (30.3%), and a document camera (30%). Further analysis that removes overlapping answers reveals that a full 49.7% of the classrooms in this study are 1:1 environments, with laptop computers, desktop computers or tablet computers for each student in the classroom always available.

Another survey question asked which technology tools are available at the school, but not always/almost always available in the classroom. Figure 2 shows the responses to this question.

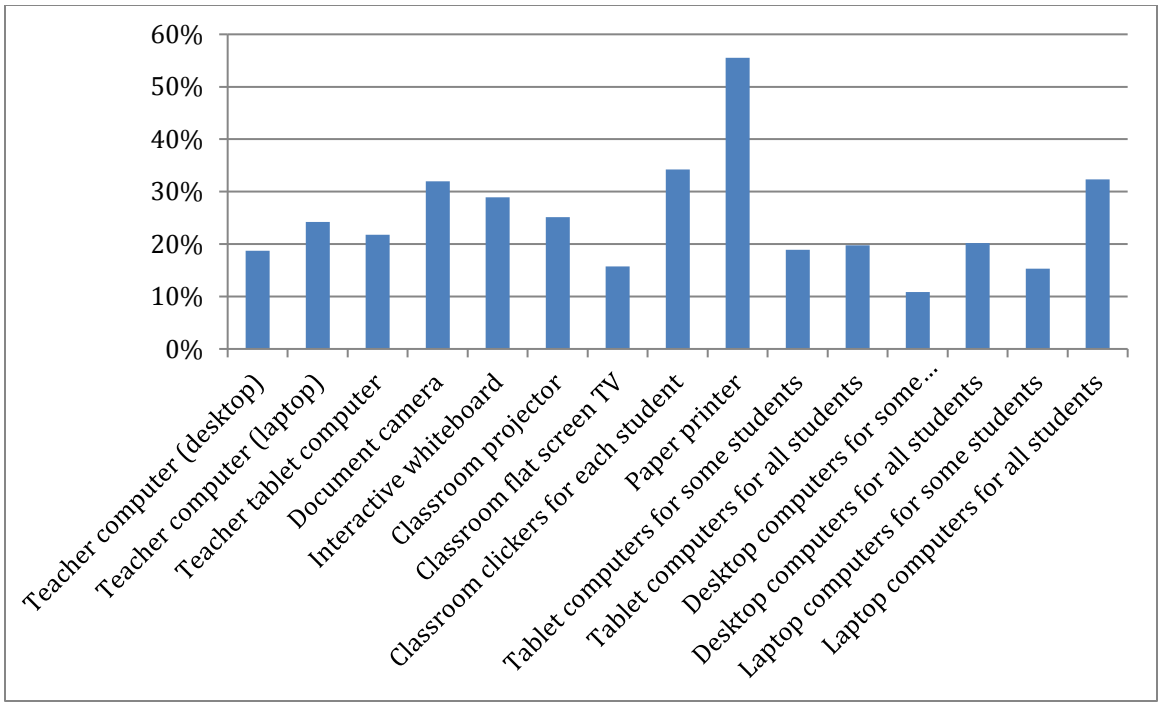

Figure 2. Technologies that are available at the school, but not always or almost always available in respondents' classrooms.

The most commonly reported technology tool that is available at the school but not in the classroom is a paper printer (55.5%). The other most common responses included classroom clickers for each student (34.2%), laptop computers for all students (32.3%) and document cameras (32%).

In comparing the differences between smaller and larger school districts on the availability of technology tools that are always in the classroom, no significant differences were found. However, for those technology tools that are available outside the classroom, significant differences were found between smaller and larger school districts.

The technology tools (in school but not always available in the classroom) that are more readily available in larger school districts include document cameras [$F(1, 1050) = 4.26$, $p =$

.039] and classroom clickers [F(1, 1050) = 11.69, p = .001]. The technology tools (in school but not always available in the classroom) that are more readily available in smaller school districts include classroom projectors [F(1, 1050) = 6.59, p = .010] and tablet computers for all students [F(1, 1050) = 9.13, p = .003].

The issue of 1:1 classrooms is an area of emphasis in the literature, therefore further analysis was completed about 1:1 classrooms. The data indicate that smaller school districts (under 1,500 students; M=52.7%) in the sample are statistically significantly more likely to have 1:1 environments than larger ones (over 1,500 students; M=41.3%) [F(8, 1044) = 4.96, p < .001]. Also, schools in smaller communities (under 5,000 people; M=59%) are statistically significantly more likely to have 1:1 environments than larger communities (over 5,000 people; M=41.8%) [F(1, 1065) = 32.36, p < .001]. Further analysis of the survey results reveals that these 1:1 environments are evenly spread between, elementary, middle school and high school environments [F(2, 865) = 2.52, p = .081].

Student-Centered Learning with Technology

The second research question in this study focused on student-centered methods of technology integration in K-12 public education classrooms and whether there are differences in these methods among larger (non-rural) vs. smaller (rural) school districts. Descriptive statistics on the questions reveal the questions that received high and low agreement.

Student-centered learning practices that received high agreement included using technology tools and resources to guide students in their discovery of knowledge (over 96%). Respondents also highly agreed (89.62%) with the student-centered learning statement, "Students use technology tools and resources to seek out and use information." Over 81% agreed that students use technology tools to work at different paces in their classroom. However, one

teacher-centered learning practice – using technology tools and resources to show online tutorials videos and activities to the whole class – also received high agreement in the survey (92.12%).

Student-centered learning practices that garnered lower agreement in the survey included using technology for authentic projects (73.22%), and for the creation of student presentations (71.64%). Two teacher-centered questions about using technology to present information to students received lower agreement (45.13% and 62.93%).

Overall the results show that teachers tend to view their technology teaching practices as student-centered, especially with guiding students in their discovery of knowledge, working at different paces and student seeking of information. Authentic projects and student presentations are student-centered learning practices that are not used as often.

Responses to questions on student-centered learning methods were averaged to determine an overall student-centered score for each survey respondent. No significant differences were found between student-centered scores among teachers in larger (more than 1,500 students) school districts and those in smaller (up to 1,500 students) school districts [$F(1, 1050) = .434$, $p = .510$]. Nor were significant differences found between districts within small (up to 5,000 people) or large (more than 5,000 people) communities [$F(2, 1075) = .631$, $p = .532$].

Since participants reported no significant differences between the different school district and community sizes, other comparisons were made to determine differences in student-centered learning with technology. Factors such as age, class size, number of students at the school, grade level, and years of teaching experience were compared.

Further analysis revealed that middle school and secondary school teachers have statistically significantly higher student-centered learning scores than do elementary school teachers [$F(2, 865) = 11.941$, $p < .001$]. Teachers that have 10-15 years of experience teaching

report using technology for more student-centered activities than teachers who have 1-4 years of experience in the classroom [$F(7, 1070) = 2.818$, $p = .007$]. Also, respondents from schools with 201-300 students are significantly more likely to have higher student-centered learning scores than those from schools with 401-500 students [$F(12, 1065) = 3.134$, $p < .001$]. None of the other listed factors were found to account for significant differences in student-centered learning scores.

Discussion

Access to technology tools and resources is vital to effective technology integration as are student-centered methods of learning. Frequent use of technology tools and resources is more likely to be found in classrooms with access to these tools and resources (Becker, 2000; Inan & Lowther, 2010; Ritzhaupt et al., 2012). Understanding what tools are available in current classrooms can help teacher educators, professional development coordinators and administrators to properly prepare teacher candidates to successfully integrate technology into learning experiences.

Available Technology Tools and Resources

The most common technology tools and resources in the classrooms for this study is the interactive whiteboard, the teacher laptop and classroom projector at a rate of 78.2%, 73% and 60.3%, respectively. The most recent (2009) report from the National Center for Education Statistics reports 40% of teachers having access to a classroom projector and only 28% of classrooms with an interactive whiteboard (Gray et al., 2010). The current study suggests that – at least in this population – first-order access to the interactive whiteboard, laptop and projector is increasing (see Ertmer et al., 2012).

Original findings from the current study suggest that technology access in rural school districts has increased and may be equal to technology access in non-rural school districts. Previous studies have suggested that access to technology as a significant issue in smaller, more rural schools and districts (e. g. Howley et al., 2011; Kale & Goh, 2014; Sundeen & Sundeen, 2013; Wright & Wilson, 2011). However, the current study found no significant differences in the availability of technology tools and resources that are available in the classroom between larger (more than 1,500 students) and smaller (up to 1,500 students) school districts. Interview respondents from smaller (rural) and larger (non-rural) school districts alike also suggested that they use technology often for various teaching and learning tasks in the classroom.

In this study, significant differences were found between smaller and larger school districts on some technology tools that were available in school but not always available in the classroom. Document cameras and classroom clickers were more readily available in larger school districts, while classroom projectors and tablet computers for all students were more available in smaller school districts. However, rather than pointing out a great divide between larger and smaller school districts, these differences may simply show a dissimilarity in priorities between larger and smaller school districts.

In 2009, the ratio of students to technology devices in education was reported to be 5.3:1 (Gray et al., 2010). It has since been suggested that the number of students to computers in the average classroom much closer to 1:1 (Ruggiero & Mong, 2015). While survey data from this study was not designed to determine the actual ratio of students to computers in each classroom, the information provided that 49.7% of sample classrooms are 1:1 suggests a ratio of computers to students that is between 1:1 and 2:1. The 1:1 classrooms in this study were fairly evenly spread between elementary, middle and high school levels.

A significant finding from the current study reveals that smaller school districts in smaller (rural) communities were more likely to have 1:1 classrooms than larger districts in larger (non-rural) communities. This original finding goes against previous suggestions that rural school districts have access to fewer technology tools and resources (e. g. Howley et al., 2011; Kale & Goh, 2014; Sundeen & Sundeen, 2013; Wright & Wilson, 2011).

Follow-up interviews conducted after the survey provide more information about this finding, suggesting that administrators in smaller schools highly support and encourage the use of technology in the classroom. One respondent from a smaller school district discussed the nature of this support, "The school and administration are very progressive. There are grants that we apply for to help buy new technology gadgets." Another respondent from a smaller school district said, "Oh yes, they (the administration) definitely do [support the use of technology], Almost to a fault I think." One interview respondent from a larger school district discussed the disparity between smaller and larger school districts, "I am baffled on how such a large school district is so far behind when it comes to technology, it is the smaller…schools that are 1:1, they have many different platforms that the kids are able to use and access. It's just kind of embarrassing to be honest with you." A teacher in a 1:1 school discussed the important role a 1:1 environment has in her decision making to use technology in the classroom, "I think the fact that the students have their own chrome books that they carry around makes it easier to use it more often and makes it easy to use every day." Other interview respondents within 1:1 schools shared a similar feeling that because devices are available for each student, they tend to use them more in the classroom.

These interview responses and other information from the study suggest several possible reasons for the existence of more 1:1 classrooms in smaller, more rural districts. Costs are much

less prohibitive for smaller districts that only have to purchase 1:1 devices for fewer than 300 students, for example, than for larger districts that may have to purchase 1:1 devices for over 3,000 students. Personnel and time devoted to technology support is also much smaller for small districts. Also, these districts may have less red tape to go through for approvals for technology purchases and they may also try to leverage technology initiatives in an effort to stay ahead of larger school districts.

Student-Centered Learning with Technology

The student-centered survey items that resulted in high agreement included using technology tools and resources to guide students in their discovery of knowledge, supporting student information seeking and working at different paces. Follow up interviews conducted after the survey share teachers' thoughts about their student- and teacher-centered practices with technology. Another respondent discussed how she uses technology to allow students to work at different paces, "It is student-centered in that they use the curriculum and move through it at their own rate." New learning models have advocated taking advantage of the possibility of differentiation with technology much in this same way (Reigeluth et al., 2016; Schwahn & McGarvey, 2012).

Follow-up interviews further show the necessity of having access to technology tools and resources for supporting student-centered learning. One respondent shared her thoughts about not having access to enough technology tools for student-centered learning, "I think our lack of resources – like the lack of machines – definitely makes it harder to let students use it, and sometimes the machines are broken…" Another respondent indicated that when students each have their own device, student-centered learning becomes more possible, "…Everybody has chrome books, that helps it to be more student-centered because they have access to everything

and it's not dependent on what the individual teacher has in their classroom or what they are comfortable with."

Other student-centered technology practices, such as authentic projects and student presentations, did not receive as high agreement in this study. One interview respondent discussed the role of authentic learning in his classes; "we do a lot of collaborative things, research projects, searching through texts and use Google docs for notes." Another respondent shared that his school is project-based learning focused and this greatly influenced teachers to use more technology for student-centered learning.

School district and community sizes didn't account for any differences between student-centered or teacher-centered practices, indicating that teachers between these groups use technologies in much the same way when it comes to student- and teacher-centered practices. However, middle and high school teachers from all districts tend to report using technology for more student-centered learning activities. This finding goes against previous suggestions that elementary teachers may be using more interactive technology tools and resources (Ruggiero & Mong, 2015), but it makes sense when we consider higher maturity and ability levels among older students which could enable them to accomplish more student-centered learning activities.

In addition, teachers with 10-15 years of experience reported using technology for more student-centered learning activities than those with just 1-4 years of experience. Previous research findings have also indicated that new teachers may use technologies less frequently for in-class learning activities (Russell et al., 2003), so the current study findings on student-centered learning may simply corroborate these results.

One interview respondent with only 1-4 years of experience teaching suggested that student-centered technology use in her classroom more common when students are using

laptops, “I would say 50:50 if I’m delivering content on the Promethean board, with their laptops, it’s almost all them.” Another respondent with 10-15 years of experience teaching suggested that she also uses a combination of student- and teacher-centered learning with technology, “I try to put the pen in the students’ hands so they’re the ones using the board…with regard to the laptops and desktops, it is student-driven because they’re the ones using and producing…”

Overall, findings from this study have shown that teachers in smaller (rural) and larger (non-rural) school districts alike use about the same amount of student- and teacher-centered technology learning practices. Findings also reveal that teachers in middle and high schools tend to use more student-centered learning practices than do elementary school teachers. Interview respondents suggest that as access to technology tools and resources increases, so does the possibility for more student-centered learning with technology.

Limitations

Limitations for this study include issues with the sample size and number of responses. The population of teachers within the state is close to the number of 12,161 total emails that were sent out, however, the researchers were only able to obtain 1,079 valid responses to the survey – a response rate of about 9%. Statistical techniques were used to take this into account and make inferences about the population based on the sample size.

These survey findings on student-centered learning must be also interpreted with caution because of the self-report nature of the survey used in this study. Teachers may report more positively on their classroom practices than is the reality. Study participants all work in a single North-Midwestern state, limiting the generalizability of findings to states or situations that are demographically and technologically similar. Also, interview respondents included a small group

of self-volunteering participants and may not necessarily reflect the opinions and interests of the population as a whole.

Because the original survey in the first sending was blocked in some school districts, teachers from these school districts may be underrepresented in this study. The researcher took care in sending out an alternative link that could be accessed by all respondents in two follow-up emails.

Conclusion

This study investigated access to and uses of technology tools and resources in public K-12 classrooms in a rural North Midwestern state. Findings indicate that access to technology tools and resources is increasing, even in smaller more rural school districts, reducing first-order barriers to effective technology integration. Overall, technologies are about equally available in both small (rural) and large (non-rural) districts, and in some cases smaller (rural) districts may have more technology tools and resources. This may be particularly true when it comes to 1:1 classrooms in which each student has a tablet or laptop computer.

The availability of tablet or laptop computers for every student provides opportunities for student-centered learning with technology as students are able to complete projects or represent their knowledge in a personal way. With the availability of more 1:1 classrooms in rural schools, it is recommended that rural school administrators and trainers focus their training and support on student-centered learning methods to fully take advantage of the available technologies for powerful learning. Larger school districts can support student-centered learning with technology through efforts to overcome a high student to device ratio.

Availability and access to technology tools and resources is a necessary condition for technology-enhanced student-centered learning activities in education. Student-centered learning

activities with technology have been advocated as best practice for enhancing student learning, however current educational practices may not be living up to this ideal (Reigeluth et al., 2016; Reigeluth & Karnopp, 2013; Ruggiero & Mong, 2015). This study shows that access to technology is increasing within public school districts, however student-centered learning methods were equally employed in both rural and non-rural school districts. As teacher educators, administrators, and professional development coordinators prepare teachers to succeed in classrooms with an abundance of technology tools and resources, they can focus on providing teachers with more experience planning for student-centered learning. This is particularly necessary among teachers with less experience.

Future research could be done to further investigate the types of technologies available in different types of classrooms, schools and school districts and to show trends for the availability of technology tools and resources. Research can also expand on the types of settings and technology tools that are used for student-centered learning as well as indicate best practices for student-centered learning using various technology tools and resources.

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